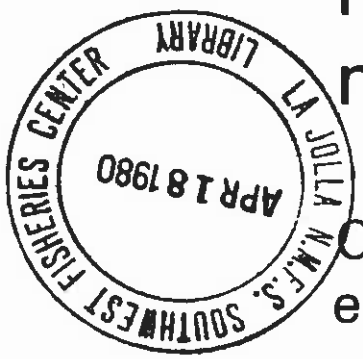

International management of highly migratory species

Centralized versus decentralized economic decision making

Dennis M. King

The author argues that the experience of the IATTC provides guidelines for evaluating and comparing proposed alternatives for the international management of highly migratory species. In the past the IATTC has only recommended policies designed to restrict the size of the harvest, whereas conflicts have arisen in the eastern Pacific tuna fishery over the production and allocation of the harvest. The author compares two proposed alternative management schemes for conservation and the resolution of international conflicts – the partially allocated quota (PAQ) system, and the quota certificate (QC) system.

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With coastal nations unilaterally extending fisheries jurisdiction to 200 miles, most commercially important fisheries are beginning to fall under management plans that are designed by individual coastal nations. In general, these coastal nations recognize the need to protect their national fisheries so conservation has been adopted as the fundamental goal in most national fishery management plans. However, the decision to bring coastal fisheries under national jurisdiction has focused some attention on other goals that need to be considered when developing a national fishery policy. In the USA, at least, worthwhile *economic goals* for national fisheries have not yet been sorted out, and in many cases discussing economic priorities with regard to the management of coastal marine fisheries is still just an entertaining political pastime. However, since the passage of the Fishery Conservation and Management Act of 1976 (FCMA) many types of economic analysis have been proposed to evaluate the social tradeoffs associated with the income, employment and market effects of fishery management alternatives. After the political issues associated with extended jurisdiction begin to settle down, these techniques should provide some useful guidelines for evaluating management options with regard to national fisheries.[1]

In addition to the coastal species that fall under national fisheries jurisdiction there are some economically important marine species, such as the tunas, that are highly migratory and pass through the fishery management zones of many nations. The fisheries for these species have unique characteristics which pose special problems for both national and international fishery policies. While it is generally agreed that no nation can manage these oceanic fisheries adequately on a unilateral basis, policy makers from different nations cannot reach agreement concerning the type of arrangements that should be established for managing them on an international basis.[2] Like coastal species, these highly migratory species have the capacity to contribute

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in many ways to national and international economic welfare so there are economic tradeoffs to consider when evaluating alternative arrangements for managing them.

However, the criteria that are being developed to evaluate the economic effects of national fisheries management are having very little impact on the way alternative management arrangements are being evaluated for these international fisheries. Apparently, there is a long-standing premise that international differences in population characteristics, resource endowments, and national priorities, make it impossible to develop any common economic criteria for evaluating international management schemes for highly migratory fisheries. This general outlook seems to have influenced the types of international agreements that have been developed to manage these fisheries in the past, and has contributed to current management problems in the eastern tropical Pacific (ETP) tuna fishery.

The international management scheme that has evolved in the ETP has aggravated international conflicts over this fishery and resulted in an economically and politically unhealthy fishery. The most well known of the two proposed alternatives for this fishery, generally referred to as the 'partially allocated quota' (PAQ) system, is shown here to be a simple variation of the existing scheme which calls for a centrally controlled market solution to the problems that have developed in the fishery. The second proposal, which is referred to as a 'quota certificate' (QC) system, has not been given much attention, and so is described in some detail. The QC system is shown to be similar to the PAQ system, except in that it prescribes a decentralized market solution to management problems. After a comparison between the PAQ and QC systems some conclusions are reached which indicate that a decentralized market solution is feasible in the ETP tuna fishery and is superior to a centrally controlled market solution in terms of conservation, economic efficiency, long-term stability, flexibility and the overall level of international economic welfare.

Tuna management in the eastern tropical Pacific (ETP)

The international regime

Since 1950 the ETP tuna fishery has been managed on an international basis by the Inter-American Tropical Tuna Commission (IATTC).[3] The IATTC maintains a permanent international staff which 'conducts scientific investigations' of ETP fisheries and recommends measures 'designed to keep populations of fishes covered under the (IATTC) convention at those levels which will permit the taking of maximum sustainable yield'.[4] Each year the member nations of the IATTC ratify an international fishing agreement which contains some provisions that are based on the scientific recommendations of the IATTC staff, and some other provisions that are negotiated by member nations to deal with political and economic conflicts.

There remains some question about whether the IATTC staff has ever had the biological information necessary to make reliable scientific recommendations; but there is little doubt that economic and political pressures within the IATTC have prevented the scientific staff from performing its task effectively.[5] In any case, most provisions of the international fishing agreements that have emerged

[1] Federal guidelines for evaluating management policies under the FCMA are contained in the *Federal Register*, 5 July 1977, and since the passage of the FCMA, the economic journals have contained numerous articles describing methods of measuring social tradeoffs in a national fishery. A collection of particularly relevant articles and a comprehensive list of references are contained in Lee G. Anderson, *Economic Impacts of Extended Fisheries Jurisdiction*, Ann Arbor Science, Ann Arbor, MI, 1977.

[2] See H. Gary Knight, *Managing the Sea's Living Resources*, Lexington Books, D.H. Heath and Co, Lexington, MA, 1977.

[3] The IATTC was formed in 1950 by a convention between the governments of the USA and Costa Rica. The convention is open to other nations whose nationals fish for tropical tuna in the eastern Pacific Ocean; in 1978 there were eight member nations including Panama, Mexico, Canada, Japan, France, and Nicaragua as well as the USA and Costa Rica. Ecuador withdrew from the commission in 1968, and Mexico and Costa Rica have filed notice of intent to withdraw, probably in 1979.

[4] The charter that established the IATTC states that the IATTC staff is to conduct, 'Investigations concerning the abundance, biometry and ecology of yellowfin and skipjack tuna in the waters of the eastern tropical Pacific Ocean and ... recommend, from time-to-time, on the basis of scientific investigations, proposals for joint action ... designed to keep populations of fishes covered by this convention at those levels which will permit the maximum sustainable yield.' See IATTC, *Annual Reports 1950-78*.

[5] See John A. Gulland, 'Alternatives for the organization of tuna management', Letter to the Editor, *Marine Policy*, Vol 2, No 2, April 1978, pp 161-163.

from the IATTC are designed to resolve economic conflicts and have not been directly associated with the conservation of the fishery. Examining the history of international conflicts over the fishery and the manner by which these conflicts have been resolved within the IATTC, it appears that the IATTC staff may have had difficulty developing an effective conservation programme for the ETP tuna fishery, even if there were an adequate scientific basis for managing that fishery.[6]

The scientific investigations conducted by the IATTC have certainly contributed to whatever success that organization has had in managing the ETP tuna fishery, but the important management function of the IATTC, in recent years, has been to resolve international conflicts over the fishery. Perhaps some concern over the structure of scientific research within the organization is warranted,[7] but the major shortcomings of the IATTC management scheme can be clearly identified with the decision-making/policy-formulating framework that was allowed to develop within the organization. The issues that have caused most management problems in this fishery involve conflicts over the allocation of fishing rights among nations and the disputed rights of some coastal nations to share in the economic value of the harvest from the fishery. It is because the IATTC management scheme has not been able to deal adequately with these types of economic management problems that the organization has been losing its capacity to manage the biological condition of the fishery.[8] The method of resolving international economic conflicts is a crucial component of any proposed management scheme for the fishery and requires special attention. Experience with the existing management programme in the ETP tuna fishery has already shown that the biological and economic condition of that fishery cannot be managed separately.[9]

Under existing international arrangements, economic conflicts over the fishery that are resolved within the IATTC are resolved in a diplomatic forum where *direct* economic negotiations are not possible. The IATTC holds an annual meeting at which representatives of member nations meet and negotiate over the size and disposition of the yellowfin quota in the Commission's Yellowfin Regulatory Area (CYRA). When each nation is satisfied an international fishing agreement is drafted, which establishes the yellowfin quota and contains special provisions that reflect the outcome of the political negotiations. These special provisions directly and indirectly assign fishing privileges to certain nations, but the agreements never contain any direct or indirect references to economic arrangements that are negotiated. The IATTC charter and the arrangements that have evolved under that charter discourage, and in some cases prohibit, acknowledgement of traditional types of economic negotiations, and they demand politically negotiated solutions, even when straightforward market negotiations might be a simpler and more effective method of resolving conflicts. In most other industries, market negotiations are used to resolve conflicts over the allocation of natural resources, and the market mechanism has proved itself to be an efficient resource and income allocating tool in many areas of resource management. However, markets have never been introduced into the management framework in the ETP tuna fishery because the staff that recommends management measures to the Commission has never had the mandate to recommend any new measures to deal with

[6] The international yellowfin quota in the Commission's Yellowfin Regulatory Area (CYRA) is the only major provision of the IATTC management scheme that has any direct effect on the biological condition of the fishery. The special closed season allocations, last free trip provision, minimum size limit on skipjack landing, and designation of experimental fishing areas, were implemented to deal primarily with political and economic problems and may have reduced the effectiveness of the IATTC conservation programme.

[7] See James Joseph, 'The management of highly migratory species: some important concepts', *Marine Policy*, Vol 1, No 4, October 1977, pp 275-288; and Gulland, *op cit*, Ref 5.

[8] Although political and economic pressures within the IATTC may result in the international yellowfin quota being set at levels that do not 'permit the taking of MSY', it has been conflict over the production and allocation of the quota, rather than conflict over the size of the quota, that have caused most international management problems in the fishery. (MSY is the 'maximum sustainable yield'.)

[9] The level of international fishing effort in a competitive high-seas fishery is associated with economic conditions; fishermen earning their livelihood in an international fishery rarely have any allegiance to national or international institutions involved in fishery management. Unless economic conditions in the fishery are controlled, competitive fishermen rarely have the incentive to comply with provisions of international fishing agreements that are ratified by government representatives, and unless fishing effort is controlled, it is impossible to manage the biological condition of a fishery.

the *allocation problems*. Political negotiations over the yellowfin quota within the CYRA has always been the accepted method of resolving international conflicts under the IATTC.

Role of the IATTC

Under the IATTC charter, any attempt by the scientific staff to recommend methods of resolving international conflicts over the production or allocation of the international harvest from the ETP would be a clear violation of its mandate. In the past, such recommendations could easily have jeopardized international support for the scientific programmes of the IATTC and would have made the task of conserving the fishery even more difficult. Therefore, almost as a matter of survival, the IATTC staff has excluded itself from whatever arrangements were worked out among nations to deal with international conflicts over the fishery. The IATTC staff has maintained its biological research programme and, since 1966, has recommended an international quota on the annual take of yellowfin tuna. However, it has never been in a position where it could respond with recommendations dealing with the serious problems that were developing in the fishery. Instead, problems related to conflicting national production targets or restricted access to fishing grounds had to be resolved separately by political leaders. This type of arrangement has allowed the IATTC, its biological research staff, and its international conservation programme to persist through many economic and political storms.

However, under this scheme, the critical management problems in the fishery were placed in the hands of political leaders and the international regime itself had virtually no control over the major problems in the fishery. For many years the crucial problems in the fishery have been associated with the production and allocation of the harvest and not with the size of the yellowfin quota that was recommended each year by the IATTC staff. Since the IATTC staff has never been capable of dealing with the major problems that were developing in the fishery, it appears, in retrospect, that the IATTC regime has never really been capable of *managing* the fishery.[10]

Over the 12 years that the IATTC has been active in fishery management, it has been criticized frequently for allowing a management scheme to develop which contributed to overcapitalization and overall economic inefficiency in the ETP tuna fishery.[11] On the other hand, the IATTC has always been defended on the grounds that even if the scientific staff was given a broader mandate and allowed to deal with economic problems in the fishery, the organization could never have resolved the international conflicts that were developing. This defence of the IATTC is usually based on the familiar claim that there are so many economic differences among the nations involved in the fishery that no international organization could propose any set of economic policies that would satisfy everyone. Ironically, the existence of economic differences among the nations involved in the ETP tuna fishery does not support this argument, but suggests instead that the fundamental problems in the fishery may have some simple economic solutions.

Political versus economic solutions

If there is any general principle that emerges from the history of international economic development, it is that nations with different

[10] Management of any kind usually implies that goals have been identified, that policies (including inaction) have been implemented to achieve goals, and that criteria have been established to evaluate how policies are affecting the achievement of goals. The IATTC may have had an impact on the take of yellowfin from the CYRA and this may have had some impact on the biological condition of the ETP tuna fishery. However, the IATTC was not in a position to set goals to manage the problems that existed in the fishery and the IATTC had no flexibility with regard to the selection of management policies. Many scarce resources are involved in the ETP tuna fishery, including international capital, labour, and energy, as well as fish; limiting the take of yellowfin from an area in the ETP only constitutes management of the fishery in a most limited sense.

[11] See Richard Marasco, 'The organization of the California tuna industry: an economic analysis of the relations between performance and conservation in the fisheries', National Marine Fisheries Service (NMFS) Economics Working Paper, No 45, Washington, DC, 1970; Dale Graydon Broderick, 'An industry study: the tuna industry', unpublished PhD dissertation, Department of Economics, Columbia University, New York, 1971; Virgil J. Norton and Saul Saila, 'Tuna: status, trends and alternative management arrangements', Resources for the Future, Program of International Studies of Fishery Arrangements Paper, No 6, June 1974; Anderson, *op cit*, Ref 1; Virginia G. Flagg, 'Alternative management plans for yellowfin tuna in the eastern tropical Pacific', Project No R/ME3, Center for Marine Studies, San Diego State University, San Diego, CA, 1977; E.A. Keen, 'The tragedy of the malstinted commons: aspects of fisheries management and extended jurisdiction', Center for Marine Studies, San Diego State University, San Diego, CA, 1978; and Dennis M. King, 'The economic theory of the fishery applied to the eastern tropical Pacific tuna fishery', in V. Flagg, ed, *Transient Tropical Tuna*, Center for Marine Studies, San Diego State University, San Diego, CA, 1978; and Dennis M. King, 'Measuring the value of the eastern tropical Pacific tuna fishery', Proceedings of the 1978 Western Division Meetings of the American Fisheries Society, San Diego, CA, July 1978.

resource endowments, technological capabilities and national economic goals can always gain from cooperative economic activity. Frequently, political leaders and political institutions restrict the types of economic arrangements that can exist between nations. However, in general, as long as political and institutional restrictions are not overwhelming, business interests in each nation will recognize the potential gains to be derived from international differences and will somehow take advantage of them.

There is no doubt that economic conditions in both underdeveloped and developed nations have improved as a result of international joint ventures and trade agreements in many economic sectors, including fisheries – the ETP tuna fishery being no exception.[12] Unfortunately, the management arrangements that have evolved in the ETP tuna fishery have inhibited economic cooperation, and have thereby prevented many potential economic benefits from being realized by the international community. Those arrangements require all negotiations to take place in a political forum where international differences are invariably perceived as sources of political conflict, rather than sources of economic gain. Even though business interests always influence the positions taken by political negotiators, positions developed for negotiations that take place in the 'diplomatic arena' are developed primarily in response to immediate problems. Long-range economic solutions are rarely considered during political negotiations, and the formal negotiations that have taken place at the annual IATTC meetings do not seem to have been any exception.

Sources of international conflict

When the IATTC first implemented an international yellowfin quota in 1966, the allowable harvest was allocated among nations on the basis of competitive fishing. This 'first come – first served' policy was intended to have no political or moral overtones, but it became obvious to underdeveloped fishing nations that under such a policy no nation could gain any economic benefits from the fishery without an efficient, competitive tuna fleet. This fact highlighted some clear economic conflicts that existed between nations such as the USA with large, efficient distant-water fleets, and nations like Mexico and Costa Rica with less competitive coastal fleets. These conflicts were resolved, to some extent, in 1968, when special 'closed season allocations' were assigned to nations whose fleets were at a competitive disadvantage in the race for fish during the open yellowfin season.[13]

More recent conflicts involve disputed claims of national sovereignty over the ETP tuna fishery; again, the developed and underdeveloped nations are on opposite sides of the issue.[14] So far, a major confrontation has been delayed because IATTC member nations have agreed to increase the special 'closed season allocations' that are assigned to coastal nations each year. Apparently this approach has been acceptable to both coastal and distant-water fishing nations, and for the past several years it has been used successfully to keep the IATTC intact. However, it never represented a rational long-range solution to economic conflicts over the fishery, and although the IATTC and the international conservation programme have survived, it has been at some cost to the international community. The delaying procedure aggravated international conflicts over the fishery and reduced international economic

[12] Three multinational corporations (H.J. Heinz Corp, Ralston-Purina Co, and Castle and Cook) process most of the tuna taken from the CYRA, and each operates subsidiaries or has financial affiliates in Latin America as well as in the USA and elsewhere. Although most tuna taken from the ETP is marketed in the USA, the multinationals frequently hold profits and capital outside the USA and employ resources from many different nations. Even when this is done for tax purposes, the corporation, the host nation, and in some cases, the USA, gain some economic benefits.

[13] There are now four separate 'resolutions' written into the IATTC convention describing special 'closed season' allocations. The details of each resolution are contained in the *Annual Reports of the IATTC*. In 1974 25-30% of the CYRA yellowfin quota was taken under special 'closed season' allocation.

[14] Ecuador and Chile withdrew from the IATTC concerning the issue of coastal state sovereignty over tuna resources within 200 miles of shore. Other 'resource adjacent nations', especially Mexico and Costa Rica, are currently involved in conflicts with distant-water fishing nations, especially the USA and Japan, over similar issues. In general the coastal nations can be classified as 'underdeveloped', and the distant-water fishing nations can be classified as 'developed'.

efficiency in the fishery by encouraging coastal nations to develop the fleet capacity to take their special allocations. Normally economic conditions in underdeveloped coastal nations discourage the development of high-seas tuna fleets.[15] However, since those nations have been given no method of receiving benefits from their 'coastal state preference' without a high-seas tuna fleet, there has been a strong incentive for them to buy used vessels or build new vessels in order to develop high-seas tuna fleets.

Under the open-access quota system that was originally established by the IATTC each nation's share in the economic wealth from the fishery depended on how much it could harvest. As a result there was a natural tendency for excess capacity to develop in the international fleet as nations attempted to increase their economic share, and this, in turn, caused overcapitalization problems to develop in the fishery.[16] This problem intensified conflicts over the allocation of the annual harvest, and more recently has jeopardized the international conservation programme; the subsequent policy of recognizing 'coastal state preference' by increasing 'closed season allocations' made the overcapitalization problem even worse.

Overcapitalization and economic conflict should be expected in an open access fishery, but the closed-season allocations caused these problems to flair up more quickly and more dramatically because it encouraged underdeveloped coastal nations to expand the size of domestic fleets to take advantage of their special allocations. There are some unusual barriers to entry associated with harvesting ETP tuna, and for several years these have prevented severe overcapitalization problems from debilitating most national tuna industries.[17]

Excess fleet capacity remains a serious threat to the ETP tuna fishery, and the problem may get worse as operating capital and fishing skills begin to accumulate in underdeveloped nations. However, at present, overcapitalization is not the critical issue that needs to be addressed when future management plans are being considered for the ETP tuna fishery. If the allocation problems in the fishery are resolved in an 'economically rational' manner, many of the traditional 'common-property problems', including overcapitalization, should be eliminated from the fishery.

At the core of the allocation problem in the ETP tuna fishery is the fact that no matter what advantage coastal nations receive through increased 'closed season allocations', most have neither the resources nor the technological skills to take what they believe is a fair share of the allowable harvest. Increasing 'closed season allocations' has certainly made it easier for these coastal nations to attract the capital and skill required to increase their economic share. However, this has not resolved the problem, and has resulted in an extremely wasteful allocation of fishing capital and an apparently unacceptable allocation of economic wealth from the fishery. There are simpler, more efficient, and more equitable methods of resolving economic problems related to the international allocation of the harvest or the international distribution of wealth from the fishery.

Alternative management systems

Several alternative international arrangements have been proposed recently to manage the ETP tuna fishery.[18] All seem to be an

[15] Because of high unemployment levels and relatively scarce capital, underdeveloped coastal nations usually develop low-technology, labour-intensive industries in order to achieve national economic goals. There is very little precedent for such nations to develop industries that are as capital-intensive as high-seas tuna purse seine fishing, which require expensive high-technology capital, employ few workers, and produce primarily for export rather than domestic markets.

[16] Fishing capital can be expected to enter a fishery as long as profits exist, and because the overall harvest level is restricted under an overall quota system, each new entry can be expected to reduce catch/capacity and profits/vessel until each national fleet is operating under an economic hardship. As this point is reached, political pressures are usually exerted on the international conservation regime as nations attempt to protect the economic viability of their national fleets, and international conflicts develop over the production and allocation of the restricted harvest.

[17] See King in Flagg, ed, *op cit*, Ref 11.

[18] See James Joseph and Joseph Greenough, *Alternatives for International Management of Tuna Resources*, University of Washington Press, Seattle, WA, 1978; Flagg, *op cit*, Ref 11; and Keen, *op cit*, Ref 11.

improvement over the existing system, because each contains some provision which allows coastal nations to share in the economic wealth of the fishery without necessarily developing their own fishing capabilities. All the proposals can accommodate species quotas to conserve the fishery, and all provide some type of negotiated 'benefit-sharing' system to resolve international production/allocation conflicts in the fishery. Because each proposal permits the same general type of *conservation* programme to exist in the fishery, the selection process is really one of deciding which scheme results in the most equitable, efficient, and long-lasting solution to international production/allocation problems. Although many reasonable alternatives exist, the two systems considered here were selected because both are consistent with the new political order in ocean fisheries, and both could be implemented in the near future without any major political disruptions.

Partially allocated quota system

The scheme that is being given most attention is one proposed by J. Joseph of the IATTC; it has been called the 'partially allocated quota' (PAQ) system. The PAQ system is, in many ways, identical to the existing IATTC scheme except that there are larger 'closed-season allocations' assigned to coastal nations, and the international organization is allowed to collect participant fees from fishing nations and redistribute them among coastal and fishing nations. The details of the PAQ system are described in Joseph and Greenough;[19] but, in general, the proposal is for an international organization to simulate the operations of a marketplace to resolve the allocation problems that exist in the fishery.

Under the PAQ scheme, a scientific staff establishes an overall quota on the regulated species of tuna, and a portion of the overall quota is allocated among coastal and fishing nations according to some generally acceptable set of criteria. The international organization then collects participant fees from each nation based on the landed value of the national harvest and redistributes these fees among coastal and fishing nations. Under this scheme, each coastal nation that receives a quota allocation is given two options – it can either harvest the national allocation, pay the corresponding participant fee, and receive an equivalent share of the redistributed participant fees, or it can allow some other nation to harvest the allocation and then collect the participant fees that were paid by the harvesting nation. In short, under a PAQ scheme, a nation can either harvest its own allocation and pay no participant fee, or receive a payment from the international organization which is about equal to the participant fees that the organization collects from any other nation that harvests the allocation. A simple type of market is actually operating under the PAQ scheme where the international organization fixes the transfer price for the national quotas by setting the participant fee, collects the fees, deducts some share of the organization's expenses, and then transfers payment from the harvesting nation to nations that do not use their national allocation.

The PAQ scheme prescribes what can be referred to as an *administered market solution* to production/allocation conflicts in the fishery. The international organization functions as a *central market authority* under the PAQ scheme and employs a complicated price and transfer mechanism to arrive at what appears to be a simple

[19] Joseph and Greenough, *op cit*, Ref 18.

market solution. It is true that real markets sometimes need to be regulated to operate efficiently and 'antitrust-type' regulations are imposed on markets all over the western world to solve various resource and income allocation problems. However, something quite different is proposed under the PAQ scheme. Under that scheme, a political organization has the power to fix the transfer price for all national allocations and control the cost of fishing for all nations. This goes well beyond the concept of a regulated market and, in fact, under this type of scheme, no natural market forces are allowed to operate at all.

Despite international differences there is no *a priori* reason to assume that the nations and corporations involved in the ETP tuna fishery are incapable of negotiating their own transfer prices in a regulated, or even an unregulated, market forum. If there is a reason why the principles of international trade break down in the ETP tuna fishery, it is not apparent; and if there is a reason why a totally controlled market is required to arrive at an acceptable market solution in the ETP tuna fishery, it has not been documented. Once the quotas are allocated among nations under a PAQ scheme, there is no apparent reason why a regulated international market could not be used to reallocate the quotas to efficient harvesters and provide an acceptable and equitable allocation of economic benefits to coastal nations without a natural economic advantage in tuna fishing.[20]

The quota certificate system, which is described in the next section, is similar to the PAQ system and permits a similar solution to the management problems in the fishery. However, it does not establish a large bureaucracy to simulate the market mechanism, and there is no central authority implementing economic policies that affect each national economy and each national fishing industry. Once the ethical questions associated with allocating the quota are negotiated, the QC system allows each nation the opportunity to decide for itself the best way to receive and measure its share of the economic benefits from the fishery. The QC scheme is based on the assumption that economic decisions are made most efficiently when independent decision makers are allowed to act in their own best interest, and least efficiently when political institutions attempt to administer what they believe to be an equitable economic solution.

Quota certificate system

An international organization would implement a quota certificate (QC) system as follows:

- The scientific staff of the organization establishes an international quota and issues quota certificates which represent exclusive rights to harvest some fixed portion of the annual quota throughout the geographic range of the ETP fishery.
- Quota certificates are allocated among nations on the basis of any agreed-on set of weighted criteria (historical fishing, length of coastline, distribution of historic catches, distribution of fishery, fleet size, etc), or on the basis of political negotiations.
- An international tuna exchange or some type of simple market forum is established to facilitate international trading in tuna and tuna-related capital and services. Within this forum, each nation is free to buy, rent, or lease fishing effort (vessels and/or crews) and trade quota certificates with any member of the international

[20] The underlying economic problem in international fisheries is that, unlike other resources, the fishery resources are 'unappropriated'. Because there is no one to collect any 'rent' from those using the fishery resources, market forces normally result in overfishing and an inefficient allocation of international resources in the fishery. Once harvesting rights are 'limited' (by establishing the international quota) and 'appropriated' (by assigning national quota allocations), the fundamental cause of common property problems is eliminated. Under these circumstances international trading could generate an efficient and equitable distribution of fishing capital and economic benefits.

community. All nations and all private corporations are allowed to participate in this market.

- A small *ad valorem* tax on tuna landings is imposed by the international organization to fund research and enforcement, and to operate the tuna exchange.

Comparing the PAQ system and the QC system[21]

The QC system is similar to the PAQ system. Under both systems the fishery remains an international resource and the biological condition of the fishery is managed by an international organization. The quota certificates merely constitute exclusive rights to harvest some fixed percentage of the international quota; the actual tonnage associated with each quota certificate varies each year with the size of the international quota. Like the PAQ scheme, the annual quota in a QC system is based on the recommendations of scientific advisers, and also the quota certificates can be allocated among nations in any manner that is acceptable to political leaders.[22] However, once the overall quota is established and the political decisions concerning the allocation of the quota made, the PAQ and QC schemes are significantly different.

Under the PAQ scheme any nation that cannot harvest its allocation, or decides that it may not want to, receives compensatory payment through the international organization by receiving some share of the redistributed participant fees. Joseph and Greenough[23] suggest that the special share received by any nation that leaves part of its allocation unutilized might be roughly equal to the participant fees collected from the nations that harvest that unutilized allocation. In other words, a nation can decide to transfer its allocation to another nation under a PAQ scheme, but only at the price that is established by the international organization when it arrives at an appropriate 'participant fee'. Similarly, any nation or individual vessel-owner that may wish to harvest part of another nation's allocation under a PAQ scheme must compete for it on the fishing grounds, and can only offer to pay the participant fee no matter how much exclusive rights to the allocation may be worth to them. The transfer conditions imposed under a PAQ system are restrictive to both coastal and distant-water fishing nations, and, because they prohibit free trade, they will result in an economically inefficient international fishery.

It must be noted that if an international organization could monitor supply and demand conditions in each national economy, a fair and efficient international market solution could be administered under a PAQ scheme. The organization would first need to compute a participant fee that was both acceptable to fishing nations and acceptable to nations which may prefer to receive some financial payment rather than harvest their national allocation; then, to keep the system efficient over time, the organization would also need some way of adjusting the participant fee (transfer price), so that it would be responsive to the economic changes that take place constantly in global tuna fisheries and within each national tuna market. In other words, the organization would have to take on the task of simulating the laws of supply and demand and make all the dynamic price adjustments that would occur naturally as a result of normal market operations – this would be extremely difficult and very expensive.

When a simple market is operating properly, it is undeniably the

[21] Under both the PAQ system and the QC system, the management options related to the incidental taking of marine mammals during commercial tuna fishing are the same. Although these options will require consideration when a management programme is established under either system, they will not be discussed here.

[22] Joseph and Greenough, *op cit*, Ref 18, describe a high allocation, based on the international harvest within 200 miles of each nation's coast and a low allocation based on the harvest by each national fleet within 200 miles of its own coast. In the first instance, about 60% of the ETP yellowfin harvest is allocated to coastal nations, and in the second instance, about 11% is allocated. In either case the unallocated portion of the yellowfin quota is available for competitive international fishing.

[23] *Ibid.*

least expensive and most effective device for computing and adjusting fair transfer prices, and the 'invisible hand' of the marketplace is much more responsive to supply and demand conditions than any political institutions could hope to be. If a real market for 'quota certificates' were allowed to operate under a QC scheme, each nation could transfer all or part of its allocation to another nation or a private corporation at a negotiated price, rather than a price administered by the international organization under a PAQ scheme. This is the only major difference between the QC scheme and the PAQ scheme; however, it is an enormously important difference. Real markets operate under the universal laws of supply and demand and are generally self-regulating, efficient and easy to understand; administered markets, on the other hand, must respond frequently to whatever political pressures prevail and do not necessarily operate under any of the economic laws that could reduce the waste of resources in an international fishery.

Assessment of systems

Comparison of benefits

It can be assumed that no matter how quotas are allocated among nations, those nations with excess allocations (in excess of national harvest capacity) would benefit from having an *option* to sell national allocations under a QC system. Therefore, most resistance to the QC system can be expected to originate in nations with excess harvest capacity (in excess of national allocations). It is important to note, however, that even if the payment for harvesting a ton of foreign-allocated tuna were the same under a PAQ system and a QC system, the cost of taking that tonnage would not be the same to the harvesting nation. Under a PAQ system foreign allocation would have to be harvested under competitive fishing conditions, while under a QC system harvesters would compete for foreign allocations in a market and the purchaser would then be allowed to take foreign allocations without excessive competition, under least-cost conditions.

The most efficient harvesters would undoubtedly have an advantage competing for foreign allocations in a market, under a QC system, or on the fishing grounds, under a PAQ system. However, because harvesting costs would be lower under a QC system, efficient harvesters are likely to earn more net economic returns under a QC system. For purposes of comparison, assume that there are unused national allocations available for international fishing, and consider the three cases where the participant fee set under a PAQ system is (1) equal to, (2) higher than, and (3) lower than the transfer price that would evolve as a result of market competition under a QC system.

In the first case efficient harvesters would pay the same 'fee' for each ton of foreign-allocated tuna that they harvested no matter which system was in effect. But fishing costs under a PAQ system would be relatively high, because the harvest would be taken under competitive fishing conditions. On the other hand, under a QC system the 'fee' would be paid for exclusive rights to foreign allocations, and the harvester would be entitled to take that tonnage under least-cost conditions. Harvesters would therefore earn more profits taking foreign allocations under a QC system than under a PAQ system.

In the second case, where the participant fee is set higher than the market price that would evolve under a QC system, efficient

fishermen would again benefit from a QC system. The cost of harvesting foreign allocations would be lower under the QC system for the reasons discussed under case 1; in addition, the fee paid for each ton of foreign-allocated tuna would be lower by the difference between the participant fee and the prevailing market price. Again, the efficient harvester would earn greater profits harvesting foreign allocations under a QC system than under a PAQ system.

In the third case, where the participant fee under a PAQ system is set below the market price that would prevail under a QC system, it would appear initially that distant-water fishermen would benefit from taking foreign allocations under a PAQ system. However, it is more likely that if such circumstances prevailed there would be no unused allocations available to the international fleet. Even if it can be assumed that there are nations inclined not to harvest their entire allocation under a PAQ system, receiving participant fees is not the only method these nations would have to obtain economic benefits from excess allocations. If the participant fees were set at a relatively low level (below a fair market price), it is reasonable to speculate that those nations would look for alternative methods of receiving economic benefits. Given the structure of the international tuna industry and the mobility of tuna fishing capital, the most logical alternative would be for them to entice foreign investors and market their allocations under 'flags of convenience'.

A few large multinational food processers compete aggressively for ETP tuna and together they control a substantial share of the fishing capital employed in the ETP tuna fishery.[24] These corporations have displayed some national allegiance in the past; but in general they register and flag fishing vessels wherever favourable financial and contractual commitments can be arranged. If participant fees under a PAQ system were set at a relatively low level, it is likely that nations with excess allocations could make better economic use of their excess allocations by hosting foreign-owned fishing capital under 'flags of convenience' until the fleet fishing under the domestic flag is sufficient to take the entire national allocation. Under these circumstances multinational corporations would be in a position to compete with each other for unused national allocations by competing for these 'flags of convenience', and it is reasonable to speculate that no unused allocations would be available for independent foreign fishermen. In other words, efficient independent harvesters would have no access to foreign allocations unless they were willing to compete for, and fish under, a 'flag of convenience'. Even if they were willing to register their vessels under a foreign flag, independent fishermen would find it difficult to compete with multinational corporations under these conditions. A low participant fee, set under a PAQ system, would eliminate some important competitive forces from the fishery, and further concentrate economic power among a few multinational corporations. Overall, it appears that efficient independent tuna harvesters would operate at a disadvantage under a PAQ system whether the level of participant fees were higher than, lower than, or equal to, the market price that would evolve under a QC system.

Possibility of identical solutions

In case 3 above it was indicated that nations with excess allocations might gain substantial economic benefits by providing 'flags of

[24] King, *op cit*, Ref 11.

convenience' for foreign fishing capital under a PAQ system. While it is certainly more likely that nations would choose this approach under the conditions described there, nations may try to attract foreign fishing capital to harvest excess allocations under many other circumstances. In fact, because of national pride, *esprit de corps*, or just political inertia, many nations may prefer to harvest their allocations under their own flag, regardless of the economic consequences and of which of the two management systems is in effect. It is important to note that the major difference between the PAQ system and the QC system is the mechanism by which national allocations are made available to foreign harvesters. If no nation has any intentions of transferring national allocations or making them available to foreign harvesters, there is very little difference between the two management systems.

If each nation harvests its entire allocation using domestic flag vessels, the allocation of the harvest under both alternative systems would be about the same. Under a QC system no trading would take place in the international market for quota allocations; under the PAQ system each nation would pay and receive the participant fees associated with their own national allocations. Further, under the QC system each nation would still pay a small *ad valorem* tax on landings to fund the international research and enforcement functions of the organization, and under the PAQ system a similar amount would be deducted from the participant fees and used by the organization for the same purposes. However, under a PAQ system the organization would also be required to collect and somehow dispose of the participant fees collected from nations harvesting any unallocated portion of the quota. Although these revenues could be used to redistribute wealth from tuna harvesters to the international community in general, it is likely that this would be politically unacceptable at present. It is more likely that the participant fee would eventually disappear, and in this case the PAQ solution and the QC solution would be identical.

Subjective comparisons of management systems

The logic and simple efficiency of competitive markets are well known, and business leaders in most modern industries welcome open-market competition and support it vehemently. However, to those involved in the tuna industry, competitive fishing is the accepted manner of weeding out inefficient harvesters and there is a good deal of emotional resistance to the idea of replacing competitive fishing with *competitive bidding*. In addition, there are knowledgeable tuna industry spokesmen who deny that exclusive fishing rights to ETP tuna could be traded in an international market and therefore reject the possibility that establishing a competitive market could make the international fishery more efficient or help solve allocation problems. Most fishermen and fishing industry spokesmen are unfamiliar with the market mechanism as a resource management tool, and base their decisions almost exclusively on what they know about the intricate international trading system that already exists in the ETP tuna fishery.[25] This is an extremely important consideration when soliciting informed opinions about the feasibility of imposing a PAQ system or a QC system in the ETP tuna fishery.

It may be that the financial and contractual arrangements that

[25] US-based multinational tuna processers frequently negotiate private financial and contractual arrangements with foreign fishery administrators and fishing industry representatives. Although the details of such arrangements are not generally available, it is apparent that some type of international trading system has evolved in the ETP tuna fishery and is understood by some members of the international tuna industry. It is also possible that private international negotiations conducted by industry leaders have had more effect on the international development of the ETP tuna fishery than the negotiations that have taken place under the IATTC.

characterize the existing economic system in the ETP tuna fishery do preclude the type of open international market operations that are proposed under a QC system. However, very little information is generally available concerning the existing system; what information is available has been provided primarily by industry spokesmen who represent the business entities that stand to lose most as a result of any change in the economic rules that govern the fishery. Whatever other effect a new management system would have on the fishery, it would be likely to alter the distribution of economic and political power. The influence of those individuals and corporate entities that have controlled the fishery in the past would very probably be reduced; thus it is very difficult to obtain an objective evaluation of any proposed management scheme from those who are involved in, or who benefit from, the existing economic system in the fishery. Industry leaders, who are the only persons who know how the existing economic system operates, generally reveal a simple preference for the *status quo* over any new arrangements, and they rarely volunteer any other comments.[26]

When experienced industry spokesmen are asked specifically to comment on a simple market solution to the production/allocation problem in the fishery, the most frequently heard response is that it might work satisfactorily 'in theory' but that it would not work 'in the real world'.[27] Without any further explanation this type of response is troublesome, even though it may come from informed and experienced spokesmen. After all, the 'real world' seems to consist of an almost infinite number of formal and informal markets where property rights, easement rights, timber rights, pattern rights, copyrights and all sorts of 'exclusive-use' rights change hands during the large number of transactions that take place daily. In general, these markets seem to operate fairly well, and when experienced industry spokesmen refer to a 'real world' in which exclusive fishing rights simply cannot be traded in a market, it merits some concern. If there are circumstances in the ETP tuna fishery under which the principles of the marketplace break down, it may be of general interest, but such circumstances are of particular concern to financial analysts who are attempting to evaluate the economic condition of the fishery for potential investors, and to professional economists who have been analysing and categorizing the causes of 'market failure' for centuries.

The circumstances under which markets fail to operate efficiently have been analysed thoroughly in the economics literature and were summarized succinctly in a paper by Bator.[28] In general, the literature describes circumstances that exist in the 'real world' under which market solutions do not achieve the level of efficiency that one would expect 'in theory'. A casual review of this literature suggests that market failures certainly exist in the ETP tuna fishery under present conditions.[29] However, the circumstances that are likely to occur after national allocations are assigned under either a PAQ or QC system are significantly different. Once the annual quota is allocated among nations there is no apparent reason why an effective international market could not operate in the ETP. In fact, the number of nations, corporations, and vessel owners that are interested in the fishery, their economic diversity, and the complete homogeneity of national quota allocations, suggest that with sufficient pricing information and with proper safeguards against the use of monopoly power, a simple inter-

[26] A basic assumption in economics is that individuals will normally act in their own best interest. This is a prudent assumption to maintain, whenever interpretations, evaluations and recommendations are being solicited from outside the scientific community. In fisheries, where policy advisers are usually more familiar with interpreting scientific data than economic data and must rely frequently on information provided by industry advisers, this assumption becomes more important. In tuna fisheries where the stakes are high economic motivation is strong, and it is not fair to ask industry spokesmen to provide objective evaluations of alternative management schemes.

[27] At present, financial and contractual arrangements that are made regarding the ETP tuna fishery are treated by most industry representatives as 'trade secrets'. To protect their own interests, industry representatives usually refuse to comment publicly on the reasons why accepted economic principles may not be relevant in the case of the ETP tuna fishery. For similar reasons, or because they are not informed, or to protect confidential data sources, scientific experts on the ETP tuna fishery follow a similar policy. As a result, those familiar with the economic theory of fishery exploitation are rarely in a position to evaluate the relevance of theory under real world conditions.

[28] Francis M. Bator, 'The anatomy of market failure', *The Quarterly Journal of Economics*, No 72, 1958.

[29] The level of concentration in the tuna industry, the extent of monopoly control over information regarding the fishery, financial and contractual arrangements that restrict entry into the fishery, imperfect pricing signals in major tuna markets and other types of market failures are discussed by King in Flagg, ed, *op cit*, Ref 11.

national market for quota allocations would greatly improve the economic health of the fishery.

It should be emphasized that under both the PAQ system and the QC system the ethical questions regarding which nations 'deserve' to share in the economic wealth from the fishery are settled when the national quota allocations are assigned. Both systems merely provide a transfer mechanism whereby nations that receive allocations can relinquish them to foreign harvesters in return for some economic share of the wealth from the fishery. In the PAQ system control of the transfer mechanism is centralized, and under the QC system it is decentralized; there is no apparent reason why either system could not operate 'in the real world'. The distribution of economic power may not be the same under each system, and this will certainly influence the support each system will receive from interest groups in each nation. However, the presentation of alternatives should not be influenced by the simple preferences of those who have economic power under the existing order, and a wide range of opinions should be solicited before either the PAQ system or the QC system is rejected as being unworkable. Control over the biological condition of the fishery may need to be centralized within an international organization, but allowing decentralized national economic decision making seems to be the most equitable and efficient approach to managing the economic condition of an international fishery.

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